Chapter 1

Challenges of Information and Communication Technologies Usage in E-Business Systems

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Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/66329

Abstract

In today's identification and data collection methods on traffic entities, large number of traffic and logistic systems uses one of the automatic identification and data capture (AIDC) technologies. The mentioned group contains information and communication technologies such as radio-frequency identification (RFID), real-time location systems (RTLS), near field communication (NFC), global positioning system (GPS), and beacon and advanced tagging technologies such as barcode and quick response code (QR code) which can be implemented with function of mobile traffic entities identification in traffic environment. In this chapter, possibilities and characteristics of mentioned technologies will be described from the aspect of their usage in traffic system through implementation of e-business. Data collection and exchange concept will be based on cloud computing and Internet of Things concepts. Through various case study examples in traffic environment, more efficient use of AIDC technologies in traffic system will be shown.

Keywords: identification, cloud computing, Internet of Things, traffic environment

1. Introduction

Automatic identification and data capture (AIDC) technologies supported by technologies such as Bluetooth and wireless fidelity (Wi-Fi) are increasingly used in today's electronic business systems. From classic usage of bank cards in business all the way to the application of the Internet of Things (IoT) environment, various classification (models) of e-businesses can be described through a number of services and solutions that are offered in today's market, based on the objects identification technologies.

In this chapter, identification technologies and connectivity are described in the model of e-business in the traffic system. Described generalized model of the traffic system is the starting point in the creation of possible e-business models in a traffic environment, that is, it allows description of traffic management component through classification of models within e-business system.

Electronic business is now completely based on modern web technologies, so this chapter presents the analysis of web technology within the development of application solutions (HTML5 and mobile applications). Conceptual model of collecting and processing data in a traffic environment is presented on the basis of modern technologies such as cloud computing (CC). Data are collected from radio-frequency identification (RFID), near field communication (NFC) tags or beacon devices connected to the Internet of Things and cloud computing environment to provide accurate and real-time information to the end user.

The chapter ends with a review of the application of AIDC technologies in the traffic environment according to the classification of the of e-business system.

2. The traffic system and classification of e-business system

The effectiveness and efficiency of the transport system can be achieved by using high-quality electronic business (e-business) systems by all interest stakeholders (companies) whose business allows its application.

2.1. The traffic system and information theory

Today, the definition of the traffic system is defined on foundational guidelines of a general systems theory and settings of systems engineering. Wherefore, the traffic is represented as a system and a process whose purpose is to carry out transport and/or transfer of transported entities (people, goods and information) using the appropriate traffic entities and taking part in roads capacity according to the established rules and protocols [1]. Generalized model of the transport system is designed as a starting model to describe the structure and behavior of any traffic system as "object of interest." Common structural components were identified and verified by an empirical-inductive method. Basic subsystems within the present generalized model are (**Figure 1**):

- subsystem of transported entities—TrE (people, goods and information),
- subsystem of adaptation of transported entity to traffic entity,
- traffic entities—TfE (pedestrian, car, plane, etc.),
- subsystem of traffic management and
- subsystem of traffic network.

The traffic entity can generally use only one medium or type of road, and the management of entity (traffic) can be individual or it can be centralized (automatic) in guidance. The adaptive control is based on the contributions of the theory and engineering tools in order to achieve

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and preserve the ideal dynamic behaviour of the process despite the modification of process parameters. Adaptive system itself is set in a wide range of changing conditions of functioning.

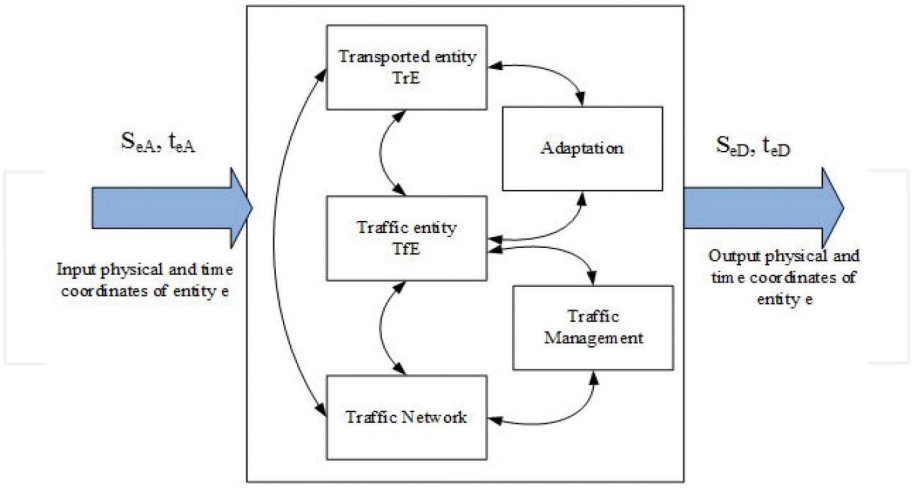

Figure 1. Generalized model of the traffic system [1].

Input physical and time coordinates of the traffic entity that enters into the traffic process are changed or transformed into desired spatial coordinates with a certain time delay, and those are:

- *tp*—time of travel,
- *teD*—time of arrival and
- *teA*— time of departure.

Travel time through the network depends on the topology (connection) of network, capacities, size of traffic flow, traffic management and the impact of incidents. In general, there is:

- l_{OD}—distance between start and destination,
- *TM*—traffic topology,
- φ—traffic flow,
- *C*—capacity of the *i* element in the network ($i = 1,..., N$),
- *NM*—network management and
- *IS*—the impact of incidents.

The traffic network generally consists of network elements that perform specific functions related to the access and service, traffic interflow, remote connectivity, additional services and network management. The control section can be treated as a separate system for the basic network of traffic flows. Management of transport network can in general be presented as a

set of functions and activities geared to set parameters of the traffic network so that it has the desired functional properties at minimum cost.

These definitions serve as a basis for more efficient management of transport network and its entities using modern information and communication technologies. For this purpose, the concept of information and communication technology is based on a combination of connected communication systems and new technologies. Modern information and communication technologies have created a completely new way of information appliance, improving the speed, capacity and quality of the process.

Information theory allows the creation of mathematical models which are the basis for simple problems. The appliance of information theory in communications allows solving problems related to the realization of process, handover, transmission, reception and storage of information and its protocols in communications network. The communications network connects sources and receivers of information through transmission channels and technical devices allowing switching and management. The communication network carries out the function of information delivery from source to destination. The communication system has the task of transferring the information from one place to another [2, 3].

2.2. The classification of e-business system

For the business models of companies whose business can affect the efficiency of the traffic system, it is important to be prepared for daily operating on electronic market. For this purpose, the concept of electronic commerce (e-commerce) presents the sale, purchase and provision of all relevant information to the end user based on the Internet, and the electronic business (e-business) includes all application solutions and enabling technologies [4].

The concept of e-business is applicable in almost all sectors and regions of the traffic system. Since the creation of the concept of e-business until today, based on its principles, significant number of business models were created and grouped according to two basic criteria:

- criteria of nature of performed tasks and
- criteria of participants or to say subjects in jobs performed electronically.

According to the criteria of the nature of performed tasks, e-business is divided into:

- model of electronic sale of own goods and services,
- model of electronic trading,
- model of electronic marketing and
- model of electronic entertainment and recreation.

Model of electronic sale of personal goods and services originated from the first standardized Internet service with the possibility of remote file transfer and its corresponding communication protocol file transfer protocol (FTP).

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Model of electronic commerce is the process of buying, selling or exchanging products, services or information through publicly accessible computer network, the Internet, and offers a great reduction in cost and time of transactions [5].

Model of electronic marketing is the way to achieve the marketing activities of the company with intensive appliance of modern information and communication technology.

The development of models of electronic entertainment and recreation is focused on the distribution of entertainment content via the Internet which led to the convergence of television, film, radio, video and Internet technologies and their integration into a single fun and recreation system. E-entertainment and e-recreation grow into the economic sector generating large profits (IT business).

Models of electronic business are defined based on the parties involved in the business process and the nature of their business relationship. Three types of subjects can participate in e-business:

- companies (business),
- ultimate consumers or customers (consumer) and
- state administration (government).

Regarding to the type of transaction that can be carried out, there are following models in electronic business:

- Communication between companies and end users (**Figure 2**):
- **Business to business** (B2B)—the model of electronic business among enterprises is a model in which participants are legal persons or companies. Enables faster and cheaper business through electronic data and fosters connection between companies. B2B model enables cost reduction, integration of the supply chain, online distribution of the goods of one company to another, increased transparency of operations, reduced inventory, short production cycle, the ability to access new markets, as well as more efficient and flexible transaction methods,
- **Business to consumer** (B2C)—B2C—the model of business management with final consumers is a direct business cooperation between companies with customers and basically refers to the online sale of products, services or information to the end customers using some of the techniques of Internet marketing,
- **Consumer to business** (C2B)—business model in which a consumer requests a product, after which the manufacturer offers a bid. Benefits are a good connection with consumers and lower production costs,
- **Consumer to consumer** (C2C)—e-business model in which individuals do business with each other. It represents the sale of products between consumers through some Internet companies that provides this type of service. The cost of such services is usually a percentage of the transaction, advertising or membership fee,

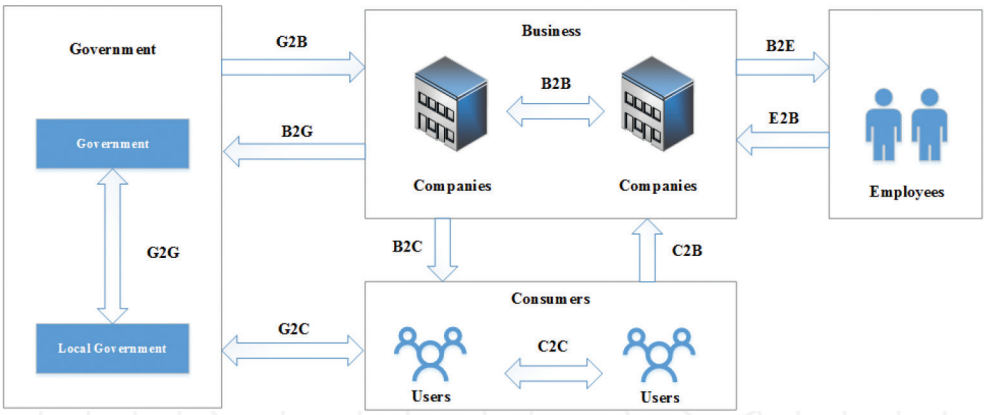

Figure 2. Classification of e-business system—business models.

- **Business to employee** (B2E)—model of e-business between a company and an employee. In practice, this model is more known as Intranet or web portal designed to provide the employees with products and/or information that they need for work,
- **Employee to business** (E2B)—business model that gives employees the possibility of business cooperation through appropriate company service.
- Communication of e-government:
- **Business to government** (B2G)—e-business model in which the state and companies from the public sector appear as buyers of goods or services offered by private companies,
- **Government to business** (G2B)—business model that enables online noncommercial interaction between companies from the public sector and large commercial companies,
- **Government to government** (G2G)—business model that allows online interaction between the bodies of state administration, ministries and the government,
- **Government to consumer** (G2C)—business model that enables online noncommercial interaction between government bodies and private individuals (citizens).
- Multiple transactions (B2B2C, C2B2C, P2P)—present combinations of already existing models.

The classification of e-business system within the environment of business models is shown in **Figure 2**. There are also visible links between individual models or subjects of the system.

The new paradigm in providing all relevant information to end users of the traffic system, based on a system of e-business, is the application of machine-to-machine (M2M) architecture. M2M communication is mostly used for remote control and is an important component in the management of inventory, remote control, robotics, traffic control, logistics services, supply chain management, fleet management, telemedicine and more. The main components of the M2M system include AIDC (RFID, NFC, real-time location system [RTLS], quick response code [QR code]) and global positioning system (GPS) and Bluetooth beacon technology. There

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is also Wi-Fi or mobile communication link and the autonomous computer software that is programmed to support networked devices to interpret the data and make decisions.

3. Analysis of modern information and communication technologies that provide the user with information

By analyzing the characteristics of modern information and communication technologies an overview of the possibilities is provided for individual technologies with an objective of more efficient operation of certain information and communication systems. Depending on their individual benefits, certain technologies can make certain modules of e-business more efficient. **Figure 3** shows the system architecture of e-business in the function of satisfying the needs of users, and providing accurate information to the end user (e.g., from submission of the request to delivery).

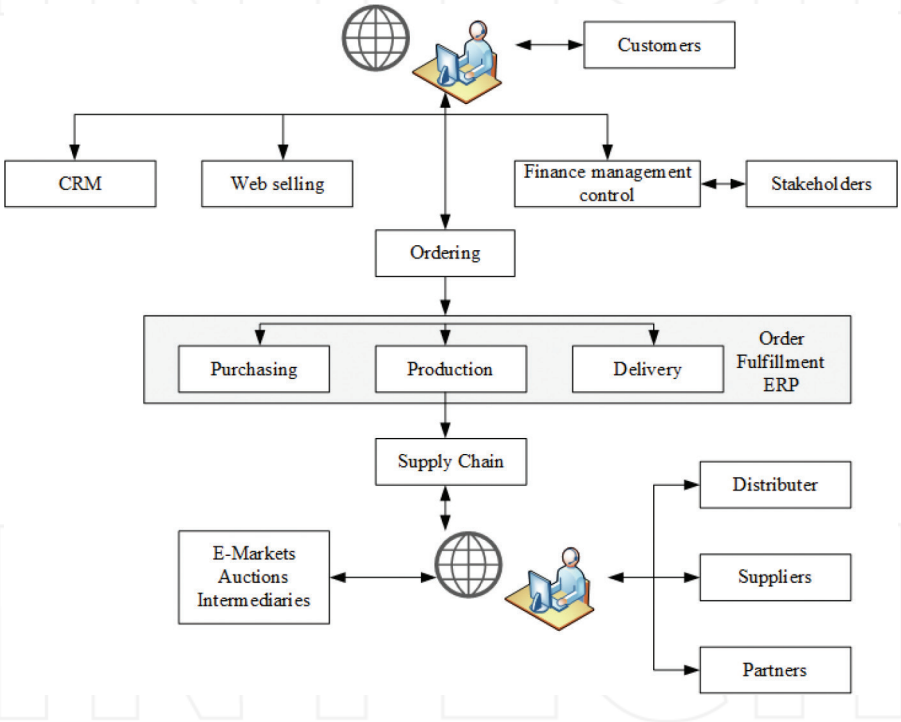

Figure 3. System architecture of electronic business [e-business].

Technologies used today are mostly based on CC concept integrated with Web 2.0, Bluetooth (beacon), RFID, NFC, RTLS and Wi-Fi technology.

3.1. Web 2.0. developing technologies

Modern Web 2.0. technologies allow better movement of the web page, and better interactive design, effective user participation in the creation of content (information), and better func-

tionality. The main feature is encouraging the involvement of users in creating content which help the website to get clear contours of look. Users are allowed to use the application through a web browser which means that the web is defined as a platform through which users have control over the data contained on a page [6, 7].

Developing technologies are important in order to achieve main features of Web 2.0. portal, such as HTML5 programming language, cascading style sheet (CSS) and JavaScript which are exclusively Frontend technologies. These technologies allow the front or the real view of web pages. Dynamic of website is achieved with programming languages depending on the server side and these are PHP Hypertext Preprocessor (Unix-Linux), ASP.NET (Microsoft), Java programming language (JSP) and ColdFusion (CFM).

The advantage of today's programming language HTML5 and CSS3 language is responsive design that allows the behaviour of content and customization for all mobile terminal devices. For this purpose, a variety of framework environments can be used, such as Bootstrap, Foundation, Sencha Touch, Onsen UI, Ionic, Semantic UI, jQuery Mobile and others. Characteristics of the development of web solution by using HTML5 programming language in relation to the development of mobile application (native App) are shown in **Table 1**.

Services	HTML 5	Native app
Quality of service depends on mobile signal and Internet connection	YES	NO
Automatic adjustment of applications for desktop and mobile version	YES	NO
Technical support on all operating systems	YES	YES
Requires special adaptation of applications for each operating system	NO	YES
Time of application execution	SLOWER	FASTER
Every system uses different programming language: Java (Android), Objective-C (iOS), Visual C++ (Windows Mobile)	NO	YES
Provides the ability to connect with a variety of functionalities of mobile devices such as: camera, accelerometer, various data stored in the device	NO	YES
The user must install the application and by doing so occupies a part of unit's resources	NO	YES
Certain security and moral standards must be fulfilled, as the terms of business, which can the time of placement	NO	YES
Possibility to charge for the download of the application through the marketplace	NO	YES

Source: Ref. [8].

Table 1. Characteristics of HTML 5 and the native application.

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The above-listed framework environments unify HTML5, CSS3 and *JavaScript* to provide the view of the front side of web application. Table compares services that are important when using e-business systems, or to say, technological components of the system that will raise the quality of services and provide unobstructed use on all operating systems. The quality of service of HTML5 depends on the access network and Internet connection, while *native app* is independent. Developing and customizing with a native app must be done separately on each operating system, which may require additional development costs of services, while with HTML5, it is not necessary given that the same version is valid for all operating systems.

3.2. Identification and connectivity technologies in an e-business environment

Technologies of connectivity and data collection in an environment of e-business system depend on the needs of the system or the user. Currently, present technologies can be divided into technologies of short and of longer range.

Short-range technologies (less than 1 [m]) are based on the electromagnetic radio waves and those are NFC, RFID (passive), QR code, magnetic cards, smart cards, voice recognition, OCR and barcode. Long-range technologies (more than 1 [m]) are Bluetooth beacon (BLE), Wi-Fi, RTLS and RFID (active) technology. **Table 2** shows the characteristics of wireless technologies from the aspect of possible collection and provision of information to the end user, depending on distance and mode.

	WI-FI	Bluetooth BLE	RFID	NFC	QR Code
Accuracy up to 10 [cm]	NO	YES	YES	YES	YES
Accuracy up to 1 [m]	NO	YES	YES	NO	YES
Accuracy up to 20 [m]	YES	YES	YES	NO	YES
Accuracy on > 20 [m]	YES	YES	NO	NO	NO
Two-way data transfer	YES	NO	YES	YES	NO
Secure data transmission	YES	YES	YES	YES	NO
External power supply	NO	YES	YES	YES	YES
Connection needed	NO	YES	YES	YES	YES
Acceptable price	YES	YES	YES	YES	YES

Source: Refs. [9, 10].

Table 2. Characteristics of individual technologies.

Technologies of connectivity and data processing are used in application of the CC concept in collecting data and providing relevant information to the end user. Therefore, these technologies are shown in **Figure 4**, where CC environment is the basic concept of collecting and storing data.

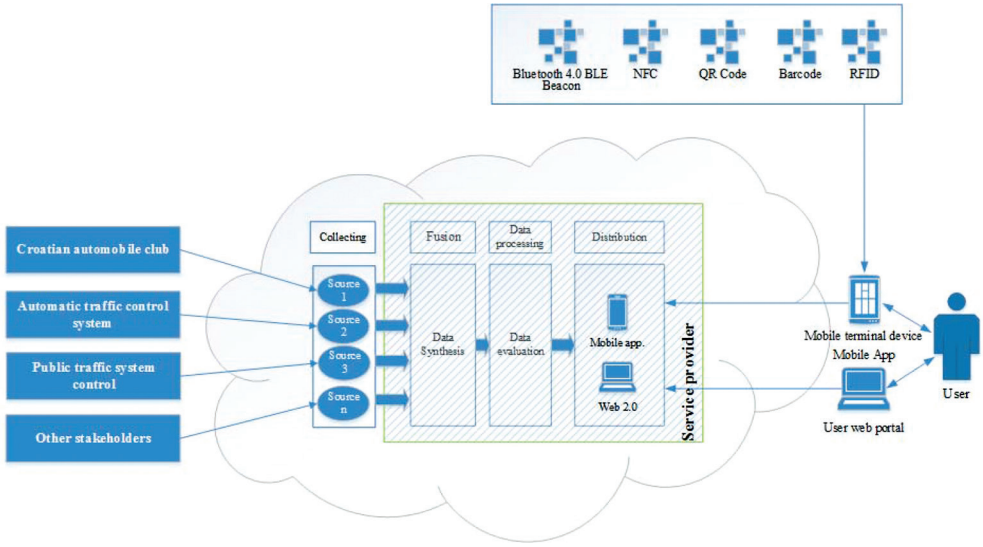

Figure 4. Architecture of the system for collecting and processing data in traffic environment.

Barcode represents a linear or one-dimensional code that uses patterns created by mixing dark lines and bright background representing a numeric or alphanumeric characters [RFID Handbook]. Data are obtained by reading the barcode with a manual or fixed barcode reader. Obtained data are saved and sent to the system as an instruction for certain changes to happen. QR code represents a significant development in the work with barcodes. QR code represents the picture in which it is possible to store information in the horizontal and vertical form (opposed to the bar code which stores information only in vertical form). QR code owns its name to the fact that it is possible to get to the stored data very quickly. QR codes can be used with smart mobile terminal device (smartphone). The user of smart mobile terminal device scans the QR code with application solution containing a stored record, and receives the requested information.

NFC is a technology by which one can perform contactless communication between devices, such as smart mobile devices and tablets. This type of communication allows the user to send the information or access the web and get the required information [11]. Although rarely used for informing users, NFC technology is commonly used for contactless payment systems in e-business, whether it was the payment of transportation, purchasing tickets and similar. Except for payment, NFC technology is used to communicate and send data between two smart mobile devices.

RFID is the term used for contactless identification through electromagnetic field or radio waves. The carriers of information with RFID technology, as well as with NFC technology, are the tags (active and passive). An example of the use of RFID technology is a public transport of passengers where this kind of transportation payment is called the automatic fare collection (AFC). It can also be used to inform the mobile user of transport network [12]. It is also greatly used in logistics; in warehouses, distribution centers and supermarkets.

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Combination of RFID technology and Wi-Fi technology defines the concept of RTLS technology whose application is recommended for large external or indoor coverage of Wi-Fi antenna [13].

Bluetooth beacons are devices that transmit signal to the nearby Bluetooth devices. By pairing them with different, appropriate, application solutions (specialized applications or classic web browser), they can be used for the delivery of requested information. Due to the range of the Bluetooth signal, it is one of the services based on the location of the user (location-based services, LBS).

Connection technologies in the CC environment can be divided into Bluetooth and Wi-Fi technologies. Bluetooth technology is used for wireless connection of equipment within the network and to transmit data by using radio transmission. The implementation of Bluetooth technology is achieved through a microchip which can achieve transfer within short range (beacon has greater ranges than Bluetooth version 4.0). This microchip is built into devices which are to be connected (e.g., mobile terminal devices, controllers, keyboard). Connection can also be achieved via universal serial bus (universal serial bus, USB).

Advantages of Bluetooth when compared to other technologies include low power consumption, simple use, acceptable price and low energy consumption. Because of these advantages, Bluetooth is applied in a growing number of information and communication solutions. Today's mobile terminal devices usually contain mounted integrated circuit with Bluetooth version 4.0. This version of Bluetooth has developed because of the need to connect the device to the IoT environment. The effectiveness of Bluetooth and its low power consumption make it a quality selection for devices within IoT environment that have to work for longer period of time. BLE version has the ability to operate on different operating systems, whose applications have different connectivity options in the CC environment.

Wi-Fi technology is a technology for transmitting data by using radio waves. It is most commonly used to provide wireless access to the Internet and for creation of wireless networks (Eng. Wireless Local Area Network, WLAN). In order to ensure proper operation of Wi-Fi technology, several standards are defined, and the most widely used standard for Wi-Fi technology is 802.11b.

4. The concept of usage of e-business system in traffic environment

In order to provide high-quality and timely information on the state of the traffic system, it is necessary to collect and process data obtained from infrastructure providers (HAK, ARZ, traffic info system of cities) [14]. Generalized model of collection and processing of traffic data is shown in **Figure 5**, where model involves adding different weight value to information of every individual source.

This model is also presented as part of the system architecture shown in **Figure 5**, and the processing takes place in the CC environment. The concept of using generalized model to provide relevant information about traffic conditions is shown through the elements of e-business (**Figure 6**).

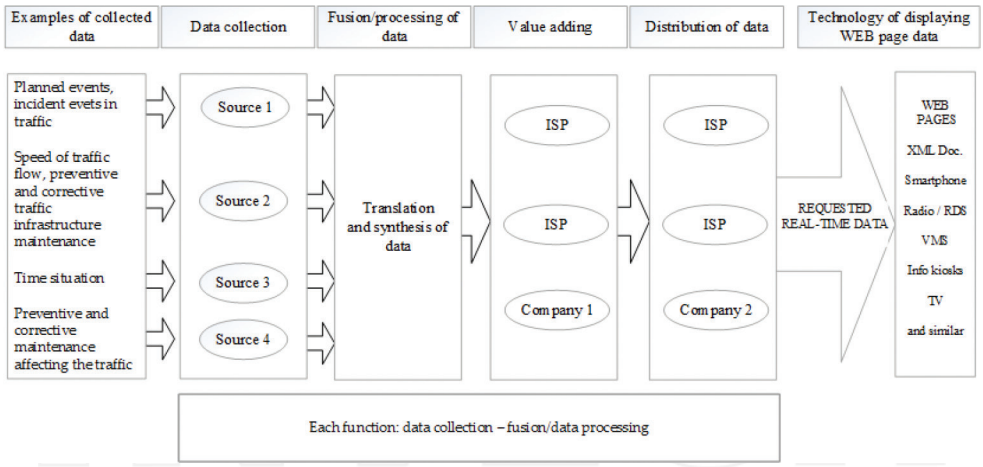

Figure 5. Generalized model of collection and processing traffic data.

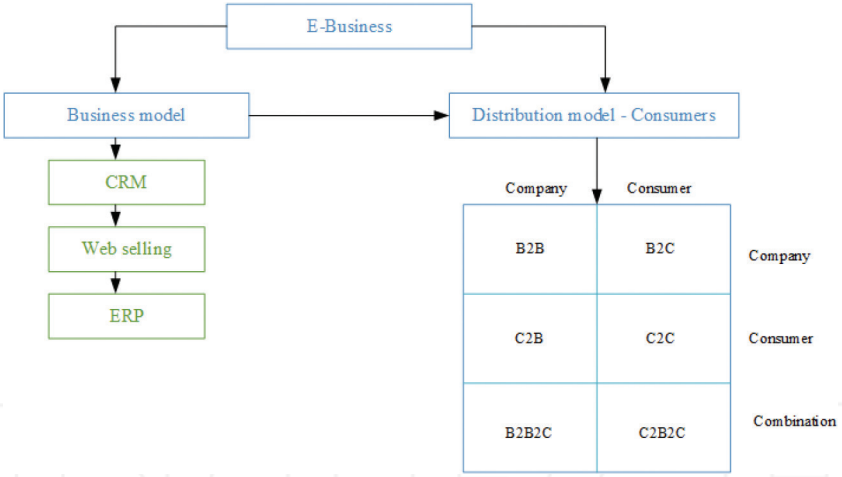

Figure 6. Distribution of information by using e-business system.

Example of a solution that delivers the technical components, business models and organizations structure of future e-marketplace is MOBiNET project. Its intention is to establish a framework that will gather private and public ITS service providers, next-generation mobility service suppliers and transport end users. On such framework providers of transport-related content and services can publish and exchange their products, compose new services and reach a wide customer base [15].

Business models contain elements relevant to business of traffic information provider. Customer relationship management (CRM) system is an important component of any company in order to

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organize and automate sales, marketing and services and help manage all information regarding clients. CRM collects various data about the users of the system with multiple channels in order to obtain a better view of customer through his use of the system and communication with the service provider. Some of the regularly monitored channels are the official website/web shop, e-mails, online chats with the operators, phone calls to customer service and communication with customers through social networks. These are valuable data on the company's relationship with the customer over time from which one can learn the habits and preferences, and anticipate some steps to define personalized offers.

Enterprise resource planning (ERP) system is a set of management tools in a company that balances supply and demand, and contains options for connecting buyers and suppliers in an integrated supply chain [16].

Web selling component of sales is based on Web 2.0. technologies whose interactive capabilities attract users to products and services offered by the company.

Model of service distribution provides specific models depending on the type of user (legal or natural person). The link to the business model is a web environment of HTML5 (PHP/ASP) technology, and extensible markup language (XML) language for labeling data stored in a database (MySQL, SQL, etc.) [17].

5. Security aspects of e-business system

Nowadays, a large number of organizations recognize the Internet as the most important communication tool and probably the most important technological development in general. Information and communications technology (ICT) systems have a major impact on communication and their potential impact on the growth of business is globally recognized [18]. Electronic business is one of the most common concepts of sales channels. The concept of e-business goes beyond the functionality of online purchases. E-business is a holistic strategy of redefining business models through technology, with the aim of gaining benefits for consumers and maximizing the profit of organization.

The selection and implementation of appropriate security controls and mechanisms in the exchange, processing and storage of data in an environment of e-business are very important in order to preserve the basic principles of security and privacy. Among other things, it includes the protection of e-business in accordance with standards such as payment card industry data security standard (PCI DSS), NIST and others, and the implementation of security controls such as cryptography, hardware solutions, programming languages and development environment, risk assessment and management, law, etc.

E-business is, among other things, intended for buying and selling products and services through information and communication systems such as the Internet. When establishing a form of e-business a number of options should be considered, such as [19]:

- The development of personal payment system for e-business, the usage of third-party solutions or a combination of previously mentioned,

- The use of various technologies in order to implement the functionality of e-business, including applications for the process of payment, the API or website for payment placed on the servers of third parties,
- It is possible to maintain multiple levels of control and responsibility for the management of IC infrastructure. For example, organizations can choose the management of the entire IC infrastructure, use the service of management of all systems and infrastructure provided by third parties (outsourcing), or they can manage a part of the infrastructure within the organization and the rest of management leave to the third parties.

Regardless the chosen option, it is necessary to consider safety aspects of implementation and appliance of e-business system.

PCI DSS is a set of policies and procedures designed to optimize safety of card business and online money transactions. PCI DSS was developed in 2004 by the four most common organizations for credit card transactions Visa, MasterCard, Discover and American Express.

PCI DSS defines six core objectives:

1. Establishment of network security
2. Protection of credit card data regardless of storage location
3. Protection of system from the activities of malicious users
4. Limitation and control of access to information and operations within the system
5. Monitoring and testing of network
6. The establishment, maintenance and observance of the formal security policy at any time and by any entity

According to the PCI DSS standard, the establishment of network security is implemented by implementing a firewall between the web server and the unprotected public networks and between the web server and internal network containing application servers and database servers. The example of isolation of system's servers in e-business is shown in **Figures 7** and **8**.

Configuration of firewall and demilitarized zone (DMZ) must ensure the passage of exclusively permitted network traffic from the public network to the web server (user request), and only of the necessary traffic from the web server to the internal network (server request), shown in **Figures 7** and **8**. Internet traffic should never be allowed to pass to internal devices outside the DMZ. Depending on network complexity and requests, the above-mentioned configuration can be deployed by using one (**Figure 7**) or two hardware firewalls (**Figure 8**).

System components designed to store credit card data must be located within the internal network zone, segmented from the DMZ and other unsafe parts of the network. In order to insure that the credit card data are protected, it is crucial to document all of the instances and security controls that protect data in the storage, processing or transmission in e-business environment. Also, it is necessary to collect and retain only the minimum amount of data required for the transaction and in the minimum period required for a specific business process. The development and appliance of technology for the implementation of e-business should not support the storage of credit card data and other sensitive information in cookies or temporary files in an

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unprotected form. Transmission of credit card data across the public network requires the application of encryption protocols such as SSL VPN, IPsec. For example, it is possible to observe the transfer of data between the user (consumer) and organizational web servers or leased service, or between organizations and various rental service providers. Previously mentioned encryption can be used to protect the transmission of other sensitive information (such as login data) and to encrypt transmission of credit card data within a corporate network. Traditional firewalls often have no possibility of inspection of encrypted network traffic. If the destination address and communications port meets the criteria defined by firewall policy, traffic will be allowed. In order to check the content of encrypted network traffic, it is necessary to consider solutions such as web application firewall (WAF) or intrusion detection system (IDS). If the e-business offers services such as chat support or other messaging technologies, it is important to emphasize the users that they shouldn't share their credit card information via such services.

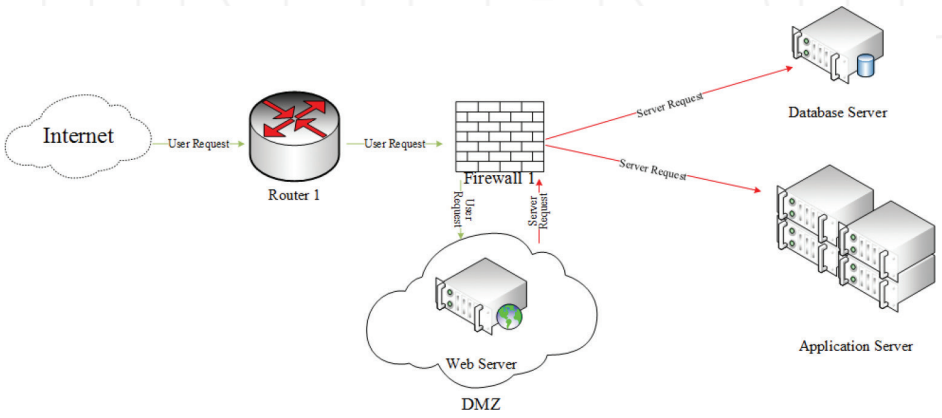

Figure 7. Network configuration with one firewall.

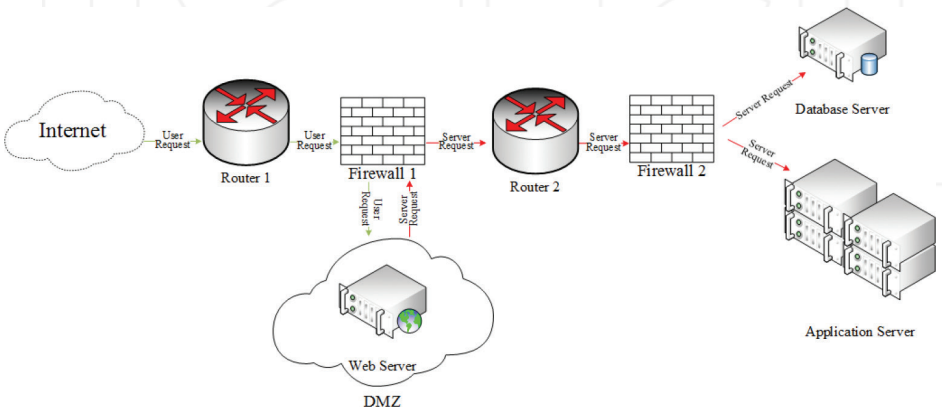

Figure 8. Network configuration with two firewall.

6. Case studies on the appliance of identification technology in e-business environment

Today, the identification technology is increasingly used for everyday needs. The adaptive mobile terminal devices enable a wide appliance of identification technology in all aspects of traffic (postal, information and communication, road transport) and logistics.

6.1. RFID in postal and logistics processes

In today's postal traffic business, the appliance of modern information and communication technologies is constantly growing. The traffic entities such as packages, envelopes and vehicles (cars, trucks, mopeds or bicycles) are marked with tags that allow easier retrieval of required information during the processing time. System architecture consists of elements: reader, tag, database and antenna (**Figure 9**) [20].

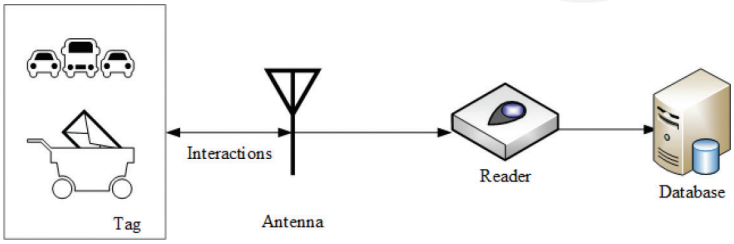

Figure 9. Possibilities of RFID usage in postal traffic.

This technology can also be used within logistics processes, where the increasing application in addition to RFID technology and other technologies from the group AIDC (barcode, QR code) technology. Tracking vehicles and trailers throughout the entire transport logistics chain provides considerable benefits to all parties involved, for example, management, users and customers. The vehicle and trailer tracking system is an advanced and effective IT system for monitoring and managing precise arrivals and departures of vehicles at specific points in the logistics chain. The system is built on the experience and know-how acquired from supplying the world's largest and most widespread RFID network stretching across about 60 countries [21]. This method of usage within the e-business environment belongs to a group of B2B and B2C business, where the end user is included.

6.2. Application in the automotive industry (roll cage tracking and managing)

In the automotive industry, the technology is used in the form of B2B, where auto parts are marked with tags, as are the boxes in which the parts are being transported to destination. An example of such operating is a car company (**Figure 10**).

After production, auto parts (1) are getting packed (2) selected and marked by RFID tags, and stored in a database (3). Then, auto parts are packed onto pallets (4) and are transported (5) to the company. When entering the company warehouse (6) the barcode or RFID tags placed on the parts are being read (7). When assembling the vehicle on the production line previously read parts are assembled into the vehicle (8) and marked pallets are returning empty.

http://dx.doi.org/10.5772/66329

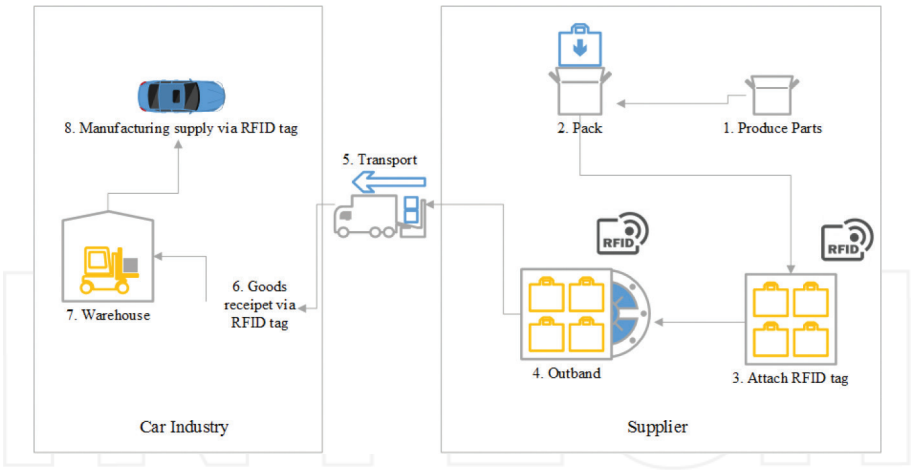

Figure 10. RFID operating within car company.

6.3. The usage of AIDC technologies as an assistive technology

Assistive technologies aim to reduce barriers and increase the mobility of persons with disabilities who are in daily movement.

For this purpose, there are a considerable number of solutions on market, depending on the degree of user's impairment. One of the solutions is the usage of RFID technology in movement of blind and visually impaired persons, as shown in **Figure 11**. This technology can also be used by persons with hearing impairment, children in particular, where the objects indicate the tags, and a reader transmits information through application solution to the computer where the objects are visually presented (LAMBERT system). AIDC technology-based solutions for persons in wheelchair can be connected into the IoT environment which is a growing challenge for many researchers in this field today [22]. These solutions are classified as B2C and C2C solutions.

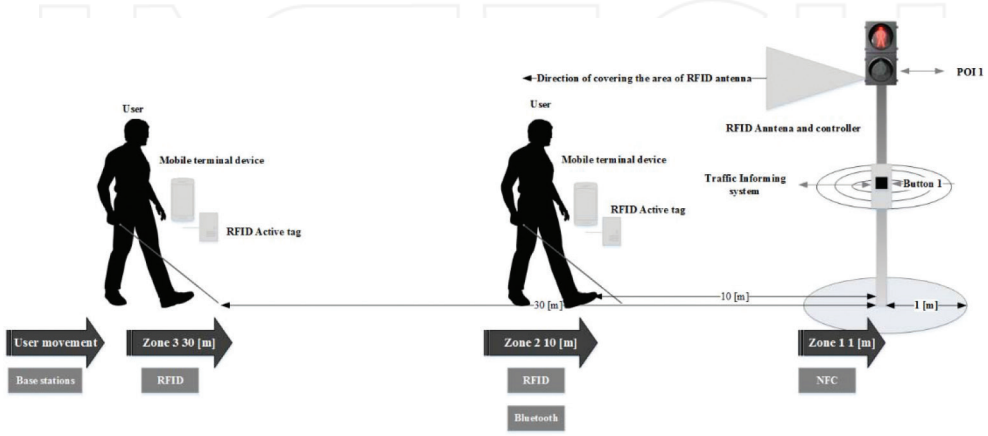

Figure 11. The appliance of RFID technology for informing visual impaired person.

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